Finally, zincethyl is decomposed by water into oxide of zinc and hydride of ethyl—

$$\left.\begin{matrix} C_4H_5Zn \\ HO \end{matrix}\right\} = \left\{\begin{matrix} C_4H_5H \\ ZnO. \end{matrix}\right.$$

It is also similarly acted upon by the hydrated acids and by the hydrogen compounds of chlorine, bromine, iodine, fluorine and sulphur.

The behaviour of zincethyl in contact with the electro-negative elements is highly remarkable, and cannot fail to have an important influence upon our views of the condition of bodies at the moment of chemical change,—a subject so ably discussed by Brodie*, whose ingenious views I consider to receive a new support in these reactions of zincethyl, by the singular way in which ethyl, a body low down in the electro-positive series, unites with oxygen, chlorine, &c., in the presence of a large excess of the intensely electro-positive zincethyl. This behaviour also strikingly confirms the suggestions I ventured to make in my former memoir†, relative to the moleculo-symmetrical form of organo-metallic compounds. In the inorganic combinations of zinc, this metal unites with one atom only of other elements; a very unstable peroxide, not hitherto isolated, being the only exception. The atom of zinc appears, therefore, to have only one point of attraction, and hence, notwithstanding the intense affinities of its compound with ethyl, any union with a second body is necessarily attended by the expulsion of the ethyl.

II. "Note on the Magnetic Medium." By Prof. A. W. Williamson. Communicated by Dr. Sharpey, Sec. R.S. Received March 15, 1855.

In a letter to Mr. Faraday recently published in the Philosophical Magazine, Dr. Tyndall brings forward some important considerations on the subject of magnetic philosophy.

It has been known for some time that the phenomena of diamagnetism may be produced artificially in bodies which are usually

* Philosophical Transactions, 1850, p. 789. † Ibid. 1852, p. 438.

considered magnetic. For this purpose it is only necessary to plunge the magnetic body into a yielding medium more magnetic than itself. When thus exposed to the action of a magnet it recedes from the poles, because the volume of the medium which it displaces is more powerfully attracted.

This fact naturally suggested the idea, that all repulsion by the magnet might be owing to the attraction exercised on the medium being stronger than that on the body repelled;—just as balloons are driven upwards by the superior weight of the displaced volume of air. And as phenomena of diamagnetism are observed in a so-called vacuum, it was thought that some "magnetic medium" might be present there.

I do not purpose on this occasion to enter upon the general question of the evidence which may be adduced for or against this important conclusion; for it could only be proved satisfactorily by considerations including phenomena of the most varied kind, such as electricity, light, chemical action, &c., to which it must necessarily apply. But it might be disproved by any one well-understood fact contradictory to it.

Now it appears to me, that the facts adduced by Dr. Tyndall are not inconsistent with the notion of a magnetic medium, but follow naturally from it; and that his argument involves a tacit assumption foreign to the theory under consideration.

The first fact adduced is, that compression increases the attraction of magnetic bodies, and the repulsion of diamagnetic bodies by the magnet, in the direction of the line of compression. Now it is evident, that a variation of pressure on a number of particles surrounded by a magnetic medium may alter the attraction of the mass by a magnet in two ways;—first, by altering the density of the matter*; secondly, by altering the density of the medium.

In a cubical mass of carbonate of iron the material particles are more magnetic than the medium which they displace, and the force with which it is attracted is proportional to this excess.

If it becomes more magnetic by compression, we must conclude that the loss of magnetic medium *from its interstices* is more than supplied by the magnetic matter which takes its place.

Carbonate of lime is less magnetic than the quantity of medium

* The word "matter" is here used for brevity to denote *ponderable* matter.

which its particles displace, and when these particles are brought closer together by pressure, with diminution of the intervening spaces occupied by the medium, the mass becomes more diamagnetic, because a certain quantity of the magnetic medium is thus replaced by the less magnetic matter.

Dr. Tyndall seems to have assumed, that on the compression of an aggregate of particles of a diamagnetic substance, the medium is not displaced by the particles in their change of position;—in which case his conclusion, that compression must increase the magnetic functions of *every* substance, would no doubt follow from the notion of a magnetic medium.

The second fact adduced differs chiefly in form from the one just considered. Crystals of carbonate of iron are attracted most strongly by a magnet acting in the direction of the crystallographic axis. Crystals of carbonate of lime, possessing the same form, are most strongly repelled in the direction of the same axis. In this direction the functions of the matter predominate more over those of the medium than in other directions of the crystal; so that with carbonate of iron, we have the strongest magnetism; with carbonate of lime, the strongest diamagnetism in this axis. One crystal consists of magnetic medium with strongly magnetic matter; the other consists of the medium with matter of very slight magnetic force.

The crystallographic axis is in both crystals the direction in which the function of matter predominates most strongly over that of the medium: so that in the iron salt it is the most magnetic; in the lime salt the feeblest magnetic direction in the crystal.